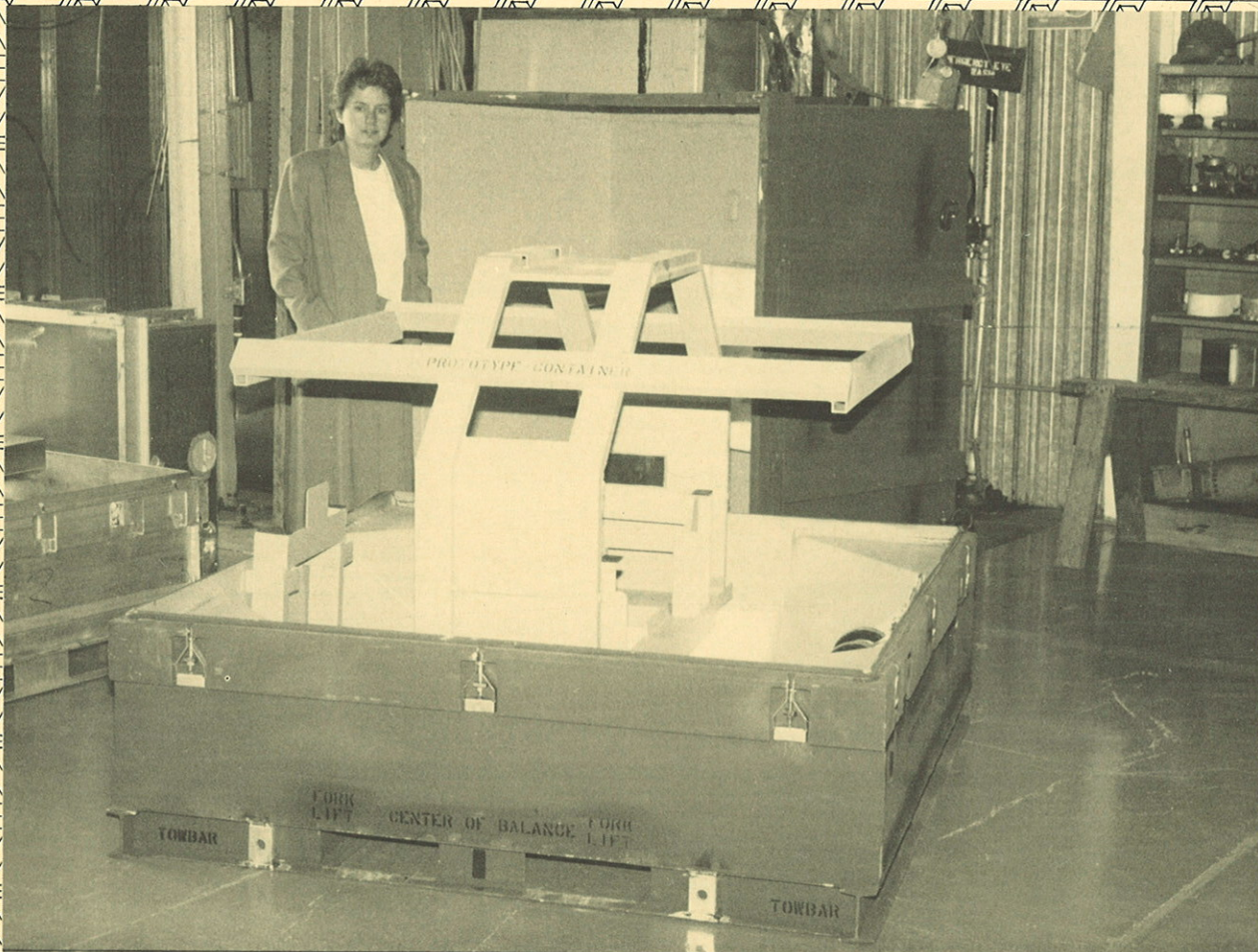


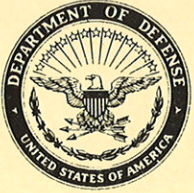
ANNUAL REPORT



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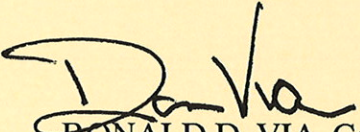
AIR FORCE PACKAGING EVALUATION ACTIVITY
WRIGHT-PATTERSON AIR FORCE BASE
DAYTON OHIO 45433





DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE LOGISTICS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

1. During 1989, the Air Force Packaging Evaluation Activity was actively involved in all aspects of packaging engineering. The items in this annual report provide an overview of the support provided in many areas which assist in maintaining our combat strength.
2. The Activity has been extensively involved in preparing to meet the UN "Orange Book" requirements for Performance Oriented Packaging (POP) testing of hazardous materials. AFPEA has been working with the Packaging Policy Office and the Wright-Patterson Contracting Center to develop a contract for POP testing, targeted for implementation in mid-1990. AFPEA container engineering support has covered the spectrum from providing engineering consulting support to the program offices, to completing the container design and prototype fabrication in-house. We have continued to work with industry, through the ASTM and SAE committees, and with other government agencies to jointly provide continued progress in packaging.
3. Future emphasis will continue to be placed on solving problems and making improvements which increase the reliability of weapon systems and equipment. We are continually evaluating new materials and designs that will improve protection and reduce costs. As in the past, we encourage both DOD and industry to share improvements which can be of benefit to our world-wide packaging operations.


RONALD D. VIA, Col, USAF
DCS/Distribution

DEPARTMENT OF THE AIR FORCE
Headquarters Air Force Logistics Command
Wright-Patterson AFB OH 45433-5999

AFLC PAMPHLET 71-7

24 April 1990

ANNUAL REPORT 1989

AIR FORCE PACKAGING EVALUATION ACTIVITY

This pamphlet is developed to detail project accomplishments for the calendar year of 1989.

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Supersedes AFLCP 71-7, 24 April 1989

No. of Printed Pages: 33

OPR: HQ AFLC/DSTZ

Approved by: HQ AFLC/DS

Writer-Editor: Mrs Gloria Baker

Illustrator: Tony Jenkins

Distribution: X

AFPEA MISSION

THE AIR FORCE PACKAGING EVALUATION ACTIVITY PROVIDES THE DEPARTMENT OF THE AIR FORCE WITH AN ENGINEERING CAPABILITY THAT IS AVAILABLE TO ALL MAJOR COMMANDS AND TO CERTAIN OTHER FEDERAL AGENCIES. TO ASSURE DYNAMIC ENGINEERING AND TECHNICAL PROGRESS IN PACKAGING, THE AFPEA INVESTIGATES, DESIGNS, DEVELOPS, TESTS, AND EVALUATES CONTAINERS, MATERIALS, METHODS, AND TECHNIQUES.

THE ACTIVITY:

- IS RESPONSIBLE FOR AN AVERAGE OF 80 PROJECTS
- MAINTAINS 44 SPECIFICATIONS AND STANDARDS
- IS AIR FORCE CUSTODIAN AND COORDINATOR OF OVER 350 SPECIFICATIONS AND STANDARDS
- IS LEAD SERVICE ACTIVITY FOR TESTING IN 12 ASSIGNED AREAS

AIR FORCE PACKAGING EVALUATION ACTIVITY

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SRAM II/T MISSILE CONTAINERS ENGINEERING SUPPORT

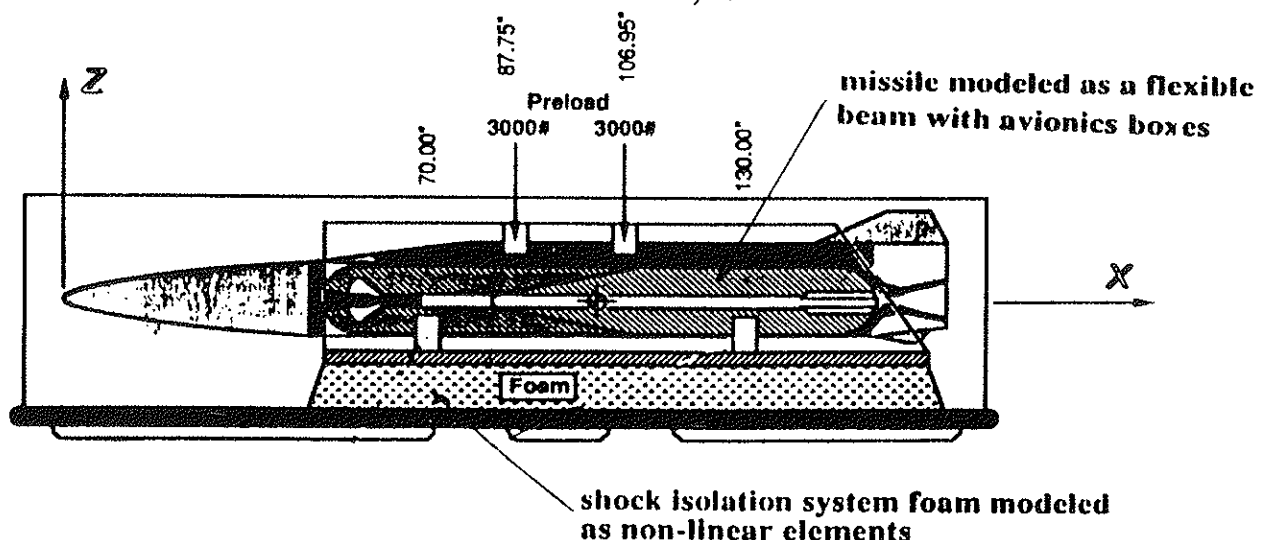
The SRAM II Program Office, ASD/YGE, requested assistance from the AFPEA in April 1989. Boeing Aerospace is the prime contractor and is designing a wooden shipping container for the SRAM II missile. The container must be capable of withstanding at least ten transportation cycles and capable of being stored for at least 30 days without environmental control. AFPEA provided engineering support by reviewing specifications and drawings and by attending a critical design review. Many changes were incorporated into the container program and design as a result of AFPEA's reviews, including additional container markings, testing at high and low temperatures, and the addition of a container gasket. AFPEA will continue to support the SRAM II office and has started to support the SRAM T effort. SRAM T is the tactical version of the SRAM II missile. The missile will be shipped worldwide and will require an aluminum container. Boeing Aerospace will design and develop the container. AFPEA will provide engineering support to the program office on the SRAM T container.

(HQ AFLC/DSTZD, Mrs Caroline Buckey, AUTOVON 787-3362)

Shipping Container Dynamic Analysis

Dynamic Model Description

Empty Box Weight	2,557
Missile Weight	1,600
Total	4,157



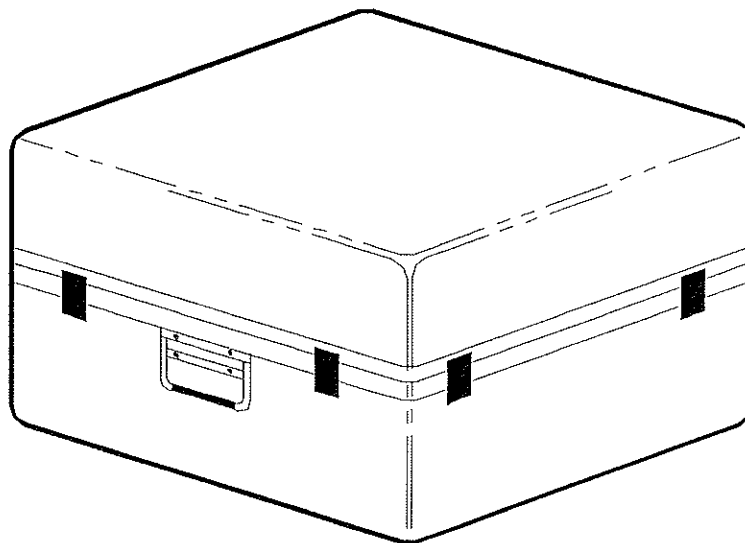
**MIL-C-4150J CASES, TRANSIT AND STORAGE, WATERPROOF
AND WATER-VAPORPROOF**

The AFPEA has revised MIL-C-4150J which will be published in FY90. This military specification establishes the requirements for water-vaporproof rigid, reusable, fire retardant, waterproof, and rectangular cases manufactured from ferrous and nonferrous metals and nonmetallic materials, such as fiberglass reinforced plastics or other composite materials.

MIL-C-4150J includes most requirements necessary for a long-life container such as a gasket, a water lip/protective lip, physical stop, free drainage, latches, desiccant receptacle, humidity indicator, pressure equalizing valve, cover handles, lifting rings, and stacking interfaces. Requirements are specified in paragraph 6.2 of the specification, allowing the procuring activity to tailor the contract or purchase order to the particular features required for the container. This greater flexibility in MIL-C-4150J should allow wider use of the document and ultimately reduce the number of similar federal and military specifications.

In addition, MIL-C-4150J can be utilized by program offices and eliminate the need to develop a new container specification for each program. Any requirements that are not detailed in MIL-C 4150J can be incorporated into a statement of work. MIL-C-4150J is an excellent document that will provide the Air Force and other DOD activities with the best possible container which meets both user and logistical requirements.

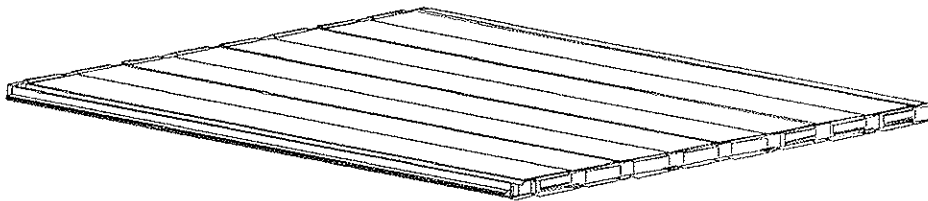
(HQ AFLC/DSTZD, Mr Ted Hinds, AUTOVON 787-3362)



463L CARGO PALLET

The AFPEA has recognized the need to redesign the Types HCU-6/E, 12/E and 10/C aircraft cargo pallets. History indicates several attempts to improve the pallet system with very insignificant results. AFPEA, with the lead service involvement in containers and capability to fabricate extruded aluminum containers, is investigating the feasibility of using the same approach in the pallet redesign. The redesign effort is intended to improve the reliability, serviceability, maintainability, and durability of the pallet while meeting all pallet requirements. More specific concerns follow AFPEA's "progressive" outlook in developing a "performance oriented" pallet specification eliminating the acceptance of a pallet based purely on materials description. The proposed redesign could then be accepted on performance alone. This approach is expected to open competition in pallet design/fabrication and reduce cost. Stated interest from Materiel Management at Warner Robins ALC, is anticipated to stem into performance testing and evaluation support by AFPEA.

(HQ AFLC/DSTZD, Mr Carey Scott Gravenstine, AUTOVON 787-3120)



MIL-V-27166C VALVE, PRESSURE EQUALIZING, GASEOUS PRODUCTS

AFPEA is currently revising MIL-V-27166C. This military specification covers low pressure relief valves for use in shipping containers that are of the controlled breathing type. The valves establish the upper and lower pressure limits at which either the internal pressure or vacuum of the container is relieved. Currently, the valve pressure requirements are specified in terms of reseal pressure. The revised specification will define pressure requirements in terms of both cracking and reseal pressures which are different depending upon valve internal friction characteristics.

(HQ AFLC/DSTZT, Mr Edward Moravec, AUTOVON 787-4519)

MIL-HDBK-304B

(PACKAGING CUSHIONING DESIGN)

In FY89, AFPEA initiated a revision of MIL-HDBK-304B. The purpose of the project was a general document update. This included deletion of obsolete materials and transmissibility curves, revision of text, review of the bibliography, removal of Chapter 5 (MIL-C-26861—Its Ramifications in Cushioning Design) and the addition of a section on electronic pulse filtering. AFPEA based the overall direction for the revision on a survey of Mil-HDBK-304 users. The projected completion date is November 1990.

(HQ AFLC/DSTZT, Mr Kenneth Dawson, AUTOVON 787-4519)

CORROSION ON B1-B PYLONS IN WOOD BOX

The INF treaty affects packaging. The B1-B Pylons contracted for by the program office were scheduled for delivery and immediate use on the B1-B aircraft. However, as a result of the INF treaty, the pylons will now be shipped to the Aerospace Maintenance and Regeneration Center and stored.

The packaging requirements for the pylons were initially level C which indicates immediate use, within three to six months. The pylons now have to be stored by AMARC for an extended period of time and subjected to periodic inspection. The pylons were stored in an unvented special design wood crate that combines requirements from both MIL-STD-26195 and MIL-C-104. As a result of extended (12 to 24 months) storage in the wood box, cadmium-plated connector plugs started to corrode. Parts covered up by loose fitting cap plugs did not corrode where they were covered. A review of the container and pylon indicated that the only possible reason for corrosion was the outgassing of formaldehyde gas from the wood which when combined with water and oxygen formed formic acid. The formic acid then attacked the cadmium-plated parts causing corrosion. A properly vented container and lubricant on the cadmium-plated parts may have prevented the problem. The proposed fix is to ventilate the box, coat the cadmium-plated parts with a light preservative, cover cadmium-plated parts with polyurethane wrap and coat the interior and exterior of the container with a four to six millimeter coat of paint (white, to reduce heat buildup) that is not gas permeable and is resistant to ozone deterioration. This action should extend the life of the container by as much as 100 percent and eliminate corrosion on the pylon.

AFPEA plans to run some tests during the next year in an effort to identify/qualify corrosion problems which may result from packaging cadmium-plated parts in wood containers.

(AFLC/DSTZD, Ted Hinds, AUTOVON 787-3362)

PACKAGING TOURS

AFPEA has been active in conducting tours during the year. During the month of May, tours were given to Headquarters Air Force Logistics Command employees to demonstrate packaging technologies and how packaging plays an important role in Distribution's ability to deliver spares and spare parts safely to our customers. In 1989 a total of 17 tours were conducted for 304 visitors.

A few of the areas covered during the tours are:

- Computer-aided design of containers used in packaging sensitive equipment that is transported worldwide.
- Electrostatic Decay testing
- Shock and vibration testing
- Corrosion

Over the last ten years AFPEA has opened its facility to over 2,400 visitors. Tours have been given to the military community, professional associations, educational institutions, and civic leaders.

(HQ AFLC/DSTZ, Mrs Gloria Baker, AUTOVON 787-2638)

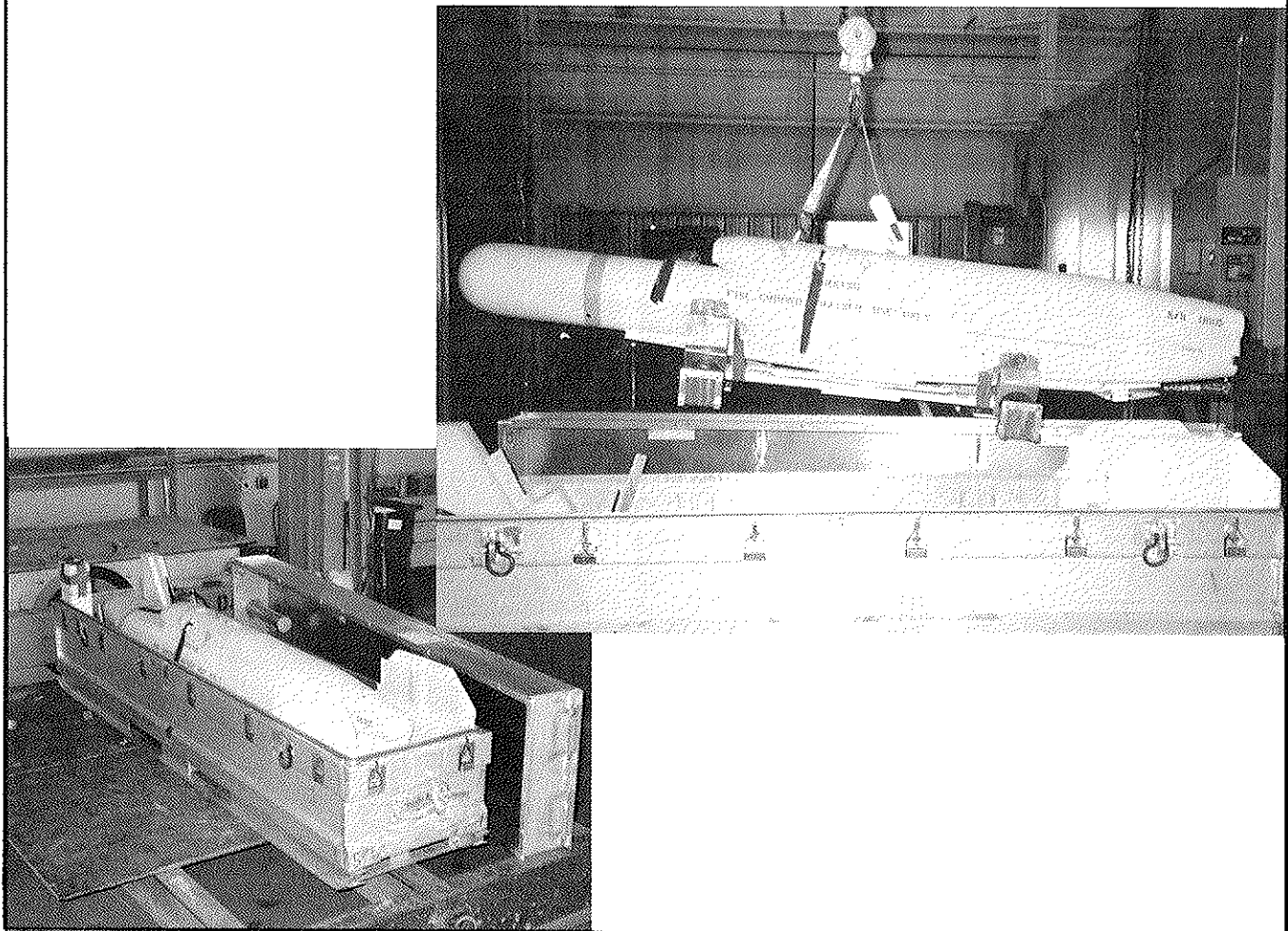


CNU-432/E QUALIFICATION TESTING

Assistance in testing was requested by the Munitions Systems Division (AFSC MSD/YBAC), Eglin AFB Florida, for AFPEA to perform the final phase of the qualification testing on the Tacit Rainbow (TR) Missile Shipping and Storage Container, CNU-432/E. The primary purpose of the test program was to verify the structural integrity of the modified lighter cradle castings. Vibration, hot and cold drops, and pendulum impact tests were performed 24-26 October 1989. The container passed all of the required tests. The test results did point out a few areas of concern, such as additional clearances needed in some areas, the accessory cushions need to be fastened more securely, and metal-to-metal contact between the missile and the cradle may damage the missile's coating. Eglin's engineers have identified changes necessary to eliminate problem areas and will incorporate changes in the design.

Overall, Eglin AFB container design engineers have designed an excellent container. The lever release cradle system was ingenious, it works well and facilitates the removal and replacement of the missile in the container.

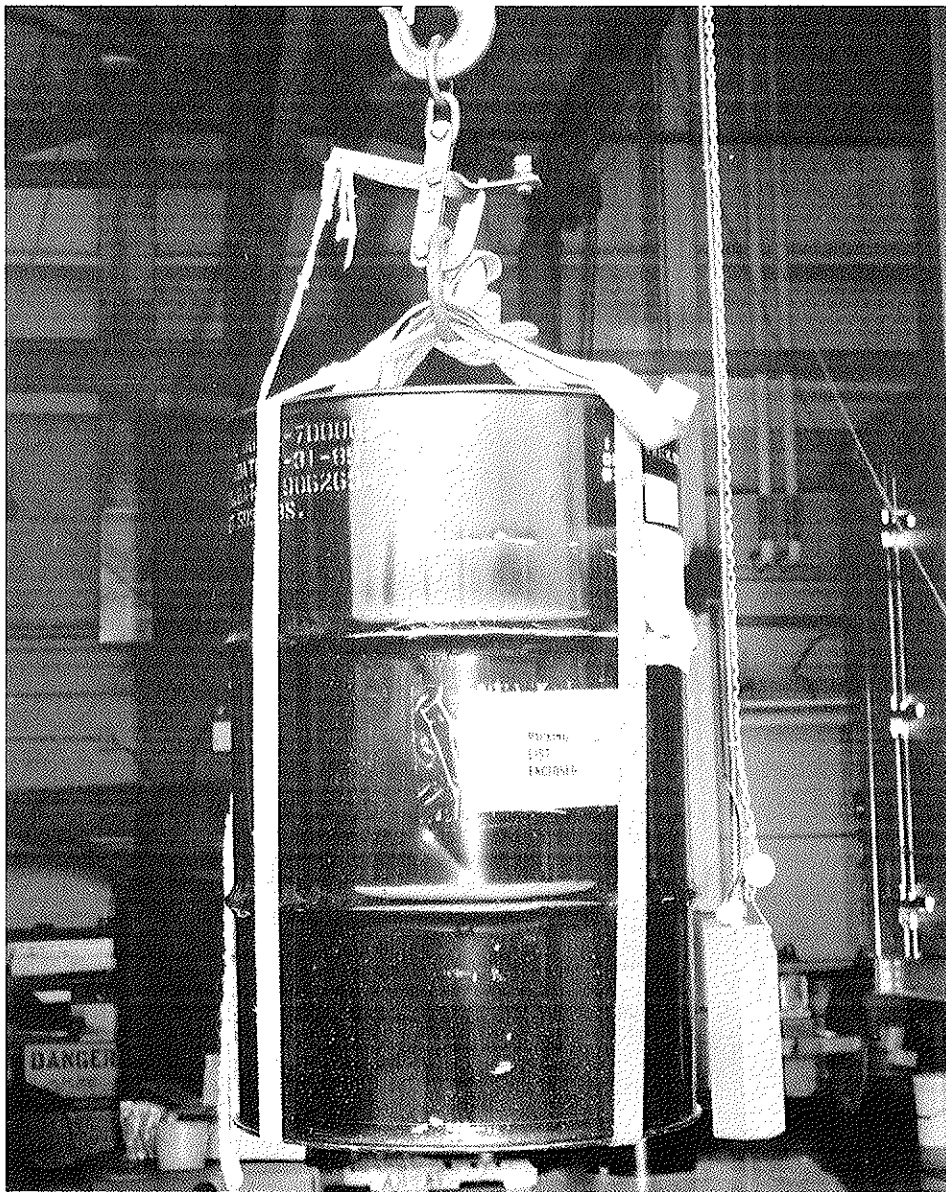
(HQ AFLC/DSTZD, Mr Floyd Wanke, AUTOVON 787-3362)



PERFORMANCE ORIENTED PACKAGING (POP) OF HAZARDOUS MATERIALS

Early fourth quarter of FY89 commitments were received from representatives from all services and Defense Logistics Agency to use the Statement of Work (SOW) developed by the Air Force for testing containers to POP requirements. Time restraints failed to allow implementation of an independent, DOD-wide contract with a certified independent test facility by the end of FY89. AFPEA and HQ Air Force Logistics Command Packaging Policy office working with Wright-Patterson Contracting Center are developing a DOD-wide contract for testing containers to POP requirements that should be operational by mid FY90.

(HQ AFLC/DSTZT, Mr Warren Assink, AUTOVON 787-4519)



COMBAT TALON II CONTAINER DEVELOPMENT

The AFPEA is providing engineering support to the Combat Talon II (CT II) program office in the design of worldwide shipping and storage containers for ten items of CT II support equipment: ku-band antenna, x-band antenna, infrared detection set (IDS), radome, and six line replaceable units (LRU). CT II is a modification of the MC-130H aircraft providing added protection to cargo and personnel by terrain following, enemy avoidance, and weather guidance. Over the past year, AFPEA completed in-house design and prototyping of the ku-band and x-band, IDS, and radome containers. As a cost-saving factor, some of the container designs incorporate handling devices, thereby eliminating the need for additional specialized ground support equipment.

The ku-band antenna container design features include retractable wheels, a yoke system, and a cradle system. The inverted cover will serve as receptacle for a downloaded antenna. The x-band antenna container design features include a cradle system, eight corner pads, and a support structure that secures a downloaded antenna. In the past year, user requested design changes to the ku-band and x-band antenna containers were incorporated into the container designs. AFPEA also provided engineering support during contract negotiations, which included cost analyses of materials and production labor hours, and analyses of manufacturing techniques. The contract is scheduled to be awarded in January 1990.

The IDS container design includes a cradle system that interfaces with an IDS handling ring developed by Texas Instruments. During 1989, prototyping, testing, and level II drawings were completed.

The radome container design uses two identical pallet systems that are stored inside the container. One pallet system holds the new radome. The other pallet is used to remove the damaged radome from the aircraft. The pallet with the damaged radome can be placed in the container for shipment to the repair depot. During 1989, the container was prototyped and fit checked at Edwards AFB CA. During 1990, both the IDS and the radome containers will be put on contract.

The LRU plastic containers were ordered from Hardigg Industries and were tested last year. The containers are being ordered and should be delivered to their destinations by June 1990.

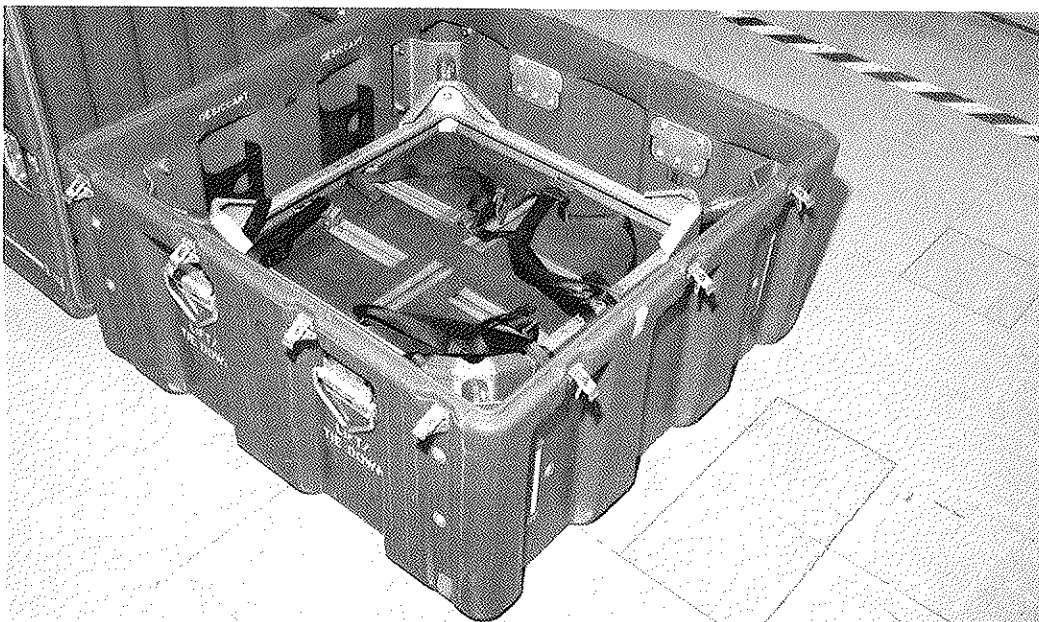
(HQ AFLC/DSTZD, Mrs Caroline Buckey, AUTOVON 787-3362)

LOW G CONTAINER SYSTEM

The low G container system consists of a set of four containers capable of 15G protection for sensitive avionics equipment. These containers accommodate items that range in weight from 10 to 91 pounds and dimensions up to 24 x 20 x 20 inches. Warner Robins Air Logistics Center procured and made three of the four containers available for requisition in the following quantities:

CONTAINER	ITEM WEIGHT RANGE (POUNDS)	ITEM SIZE INCHES MAX/MIN	QUANTITY
8145-01-235-1113	10-16.5	10.5x9.75x9.25/ 4x4x5	68
8145-01-235-1112	12-25	21x21x15.75/ 8x6x5	351
8145-01-236-5003	25-54	21x21x15.75/ 12x6x6.75	120

(HQ AFLC/DSTZT, Mr Kenneth Dawson, AUTOVON 787-4519)

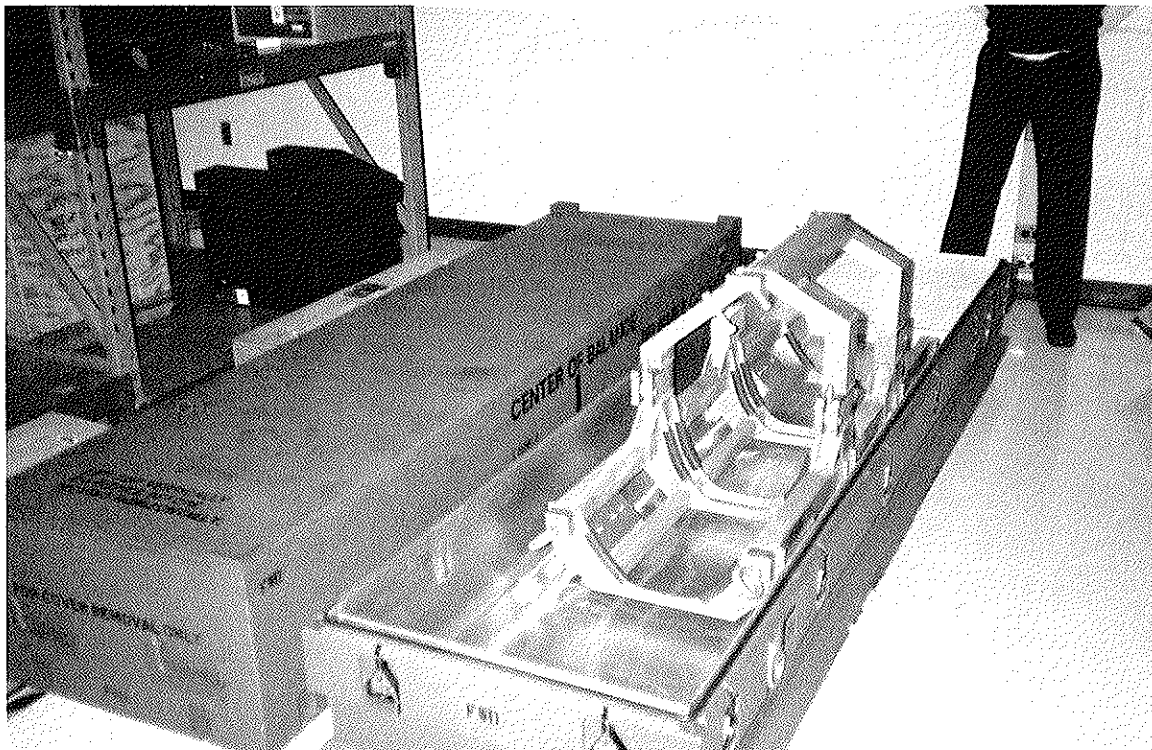


LOW ALTITUDE NAVIGATION AND TARGETING INFRARED SYSTEM (LANTIRN) CONTAINER DESIGN

The LANTIRN program is accepting delivery of both navigation and targeting pod containers which have passed all container qualification tests and meets both user and logistical requirements. Stanley Aviation working as a subcontractor to Martin Marietta provided a new container design using specialized aluminum extrusions. The container was designed, prototyped and tested within nine months. The navigation and targeting pod containers are identical except for the internal shock attenuation system and cradles. The container design fits into standard production processes with no special equipment required.

The LANTIRN navigation and targeting pod containers provide environmental protection to the pods from both the induced and natural environment during transportation, storage, and handling. The basic container design and concepts are great and will in all probability allow for years of trouble/maintenance free use by the Air Force. Our hats are off to the program office for a container that will work, be easy to use, be virtually maintenance free, last for years, and be easily produced. The Air Force won one.

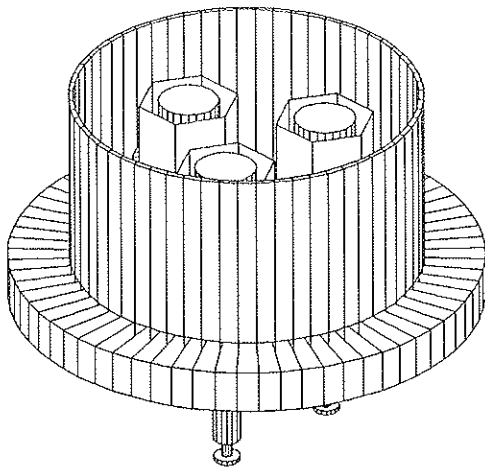
(HQ AFLC/DSTZD, Mr Ted Hinds, AUTOVON 787-3362)



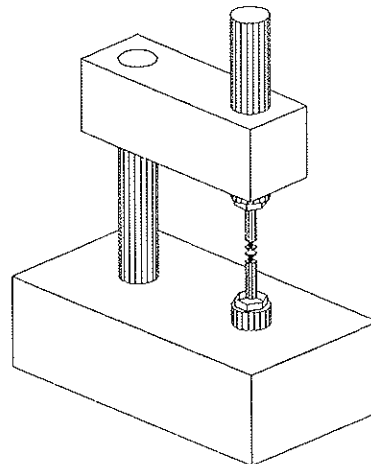
ELECTROSTATIC DECAY TESTING

New testing methods are currently being evaluated for electro static decay (ESD) of materials. The American Society for Testing Materials (ASTM) proposed two test methods. These methods are the three point surface resistivity and the two point volume resistivity. AFPEA developed its own ESD test fixture, in conjunction with ASTM's test methods, for cushioning materials. These tests are being developed by AFPEA, with guidance from ASTM, to better determine the electrostatic properties of cushioning materials. Knowledge of and advancement toward new cushioning materials and testing methods will improve the Air Force's packaging procedures in protecting ESD sensitive parts and equipment. Test plans, using these test methods, are in the process of being drafted. The test plans will evaluate the test methods and test fixtures for accuracy and repeatability.

(HQ AFLC/DSTZT, Mr Robert Tekesky, AUTOVON 787-7445)

ASTM TEST FIXTURES

**THREE POINT SURFACE
RESISTIVITY**



TWO POINT VOLUME RESISTIVITY

PACKAGING EVALUATION TEST EQUIPMENT

The next few pages detail principal equipment of Air Force Packaging Evaluation Activity's (AFPEA) test and evaluation capabilities. The equipment is used extensively to eliminate existing packaging problems and to avoid introducing new problems into the system. Evaluations are made on new containers and materials intended for Air Force/Department of Defense use. (Dimensions are in inches unless otherwise specified.)

3. HIGH TEMPERATURE/HUMIDITY WALK-IN ENVIRONMENTAL CHAMBER:

TEMPERATURE RANGE: 35 to 200 degrees F (2 to 92 degrees C)
HUMIDITY RANGE: 50 to 95 percent
INSIDE DIMENSIONS: 99 width x 190 length x 96 height
(251 cm width x 483 cm length x 244 cm height)
DOOR OPENING: 60 width x 84 height (152 cm width x 213 cm height)
DROP TEST CAPACITY INSIDE OF CHAMBER: 4000 pounds (1814 kg)

4. PENDULUM IMPACT TESTER:

CAPACITY: 5000 pounds (2268 kg)
CONTAINER MAXIMUM SIZE: 104 width x 216 length x 144 height
(263 cm width x 549 cm length x 366 cm height)

5. RAIN/SALT-FOG/WIND WALK-IN ENVIRONMENTAL CHAMBER:

TEMPERATURE RANGE: Ambient
RAIN CAPABILITY: 2 or 5 (5 or 13 cm) rain/hour
SALT-FOG CAPABILITY: 5 percent salt solution by weight
WIND VELOCITY: 40 miles per hour (64 km/hour)
INSIDE DIMENSIONS: 76 width x 160 length x 78 height (193 cm width x 432 cm length x 198 cm height)
DOOR OPENING: 62 width x 79 height (157 cm width x 201 cm height)

6. ALTITUDE CHAMBER:

TEMPERATURE RANGE: -100 to 350 degrees F (-73.3 to 177 degrees C)
ALTITUDE: Site Level to 100,000 feet (30,667m)
INSIDE DIMENSIONS: 48 width x 48 length x 48 height (122 cm width x 122 cm length x 122 cm height)

7. THERMAL OVEN:

TEMPERATURE RANGE: +100 to +500 degrees F (+40 to +260 degrees C)
INSIDE DIMENSIONS: 48 width x 117 length x 60 height (122 cm width x 297 cm length x 152 cm height)
DOOR OPENING: 48 width x 60 height (122 cm width x 152 cm height)

11. ELECTROSTATIC DECAY (ESD) TEST AREA:**a. TEST CHAMBER:**

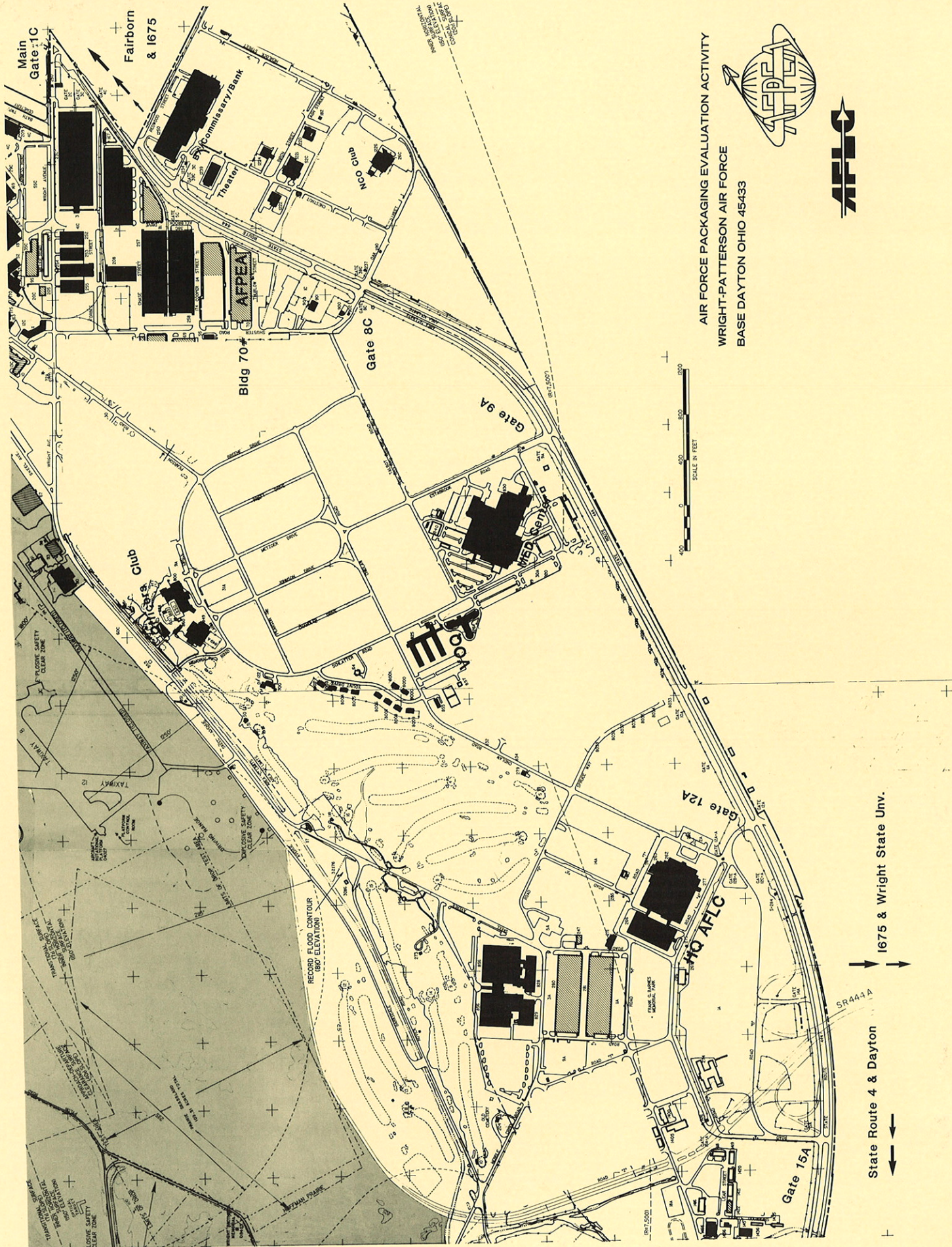
TEMPERATURE RANGE: Ambient
HUMIDITY RANGE: 8 to 15 percent
DIMENSIONS: 36 length x 24 width x 18 height
(91 cm length x 61 cm width x 46 cm height)
DOOR OPENING: 12 x 12 (30 cm x 30 cm)
CONTROL: Passive and active "Dessicant" systems

b. STATIC DECAY METER:

PEAK CHARGE: $\pm 5\text{Kv}$
DECAY TIMER: 0.01 to 99.99 seconds
SAMPLE SIZE: 3 x 5 (8 cm x 13 cm)
TEST METHOD: Federal Test Method Standard 101C,
Method 4046

c. KETHLEY ELECTROMETER:

RANGE: 100 ohms full scale to 10^{14} ohms in twenty-five linear 1x and 3x ranges
ACCURACY: ± 3 percent of full scale on 100 to 10^{10} ohm ranges using the largest available multiplier setting; ± 5 percent of full scale on 3 x 10 ohm ranges.



AIR FORCE PACKAGING EVALUATION ACTIVITY
 WRIGHT-PATTERSON AIR FORCE
 BASE DAYTON OHIO 45433



1675 & Wright State Univ.

State Route 4 & Dayton



ONE TEST IS WORTH
A THOUSAND
EXPERT OPINIONS